



A new Portholefish of the genus *Diplophos* (Stomiiformes: Gonostomatidae) from the western Pacific Ocean

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Abstract

A new Portholefish, *Diplophos vicinia* sp. nov., is described on the basis of nine specimens collected from the western Pacific Ocean by commercial midwater trawl. The new species, currently known only from the South China Sea and north of Papua New Guinea, can be easily distinguished from six nominal congeners by the combination of the following characters: dorsal-fin origin closer to snout than caudal-fin base, distance between last two AC photophores half that between preceding photophores, gill rakers 4 + 10–11=14–15, abdominal vertebrae 30–32, caudal vertebrae 44–45, total vertebrae 74–76, and the following photophore counts: IP 13–14, PV 18–19, IV 31–32, VAV 12–13, AC 37–39 + 2, and IC 83–86.

Keywords: *Diplophos vicinia*, taxonomy, morphology, luminescence, deep sea, South China Sea

Introduction

The portholefish family Gonostomatidae is a group of mesopelagic marine fishes, represented by about 8 genera and 33 valid species (Nelson *et al.* 2016; Fricke *et al.* 2019). Species of the genus *Diplophos* are characterized by the following: dorsal-fin origin well anterior to anal-fin origin; photophores present on isthmus; more than 2 rows of photophores on body, VAV 12–17, IV 30–49, AC 28–49 (straight), IC 70–119, OA 45–87, BR 8–16; ORB photophore below or slightly anterior to front margin of eye; lower gill rakers 7–10; upper and lower jaws uniserial, except for short outer row anteriorly; a row of small photophores on posterior half of lower jaw; single tooth row on premaxillary; and pseudobranchiae present (Grey 1960, 1964; Fujii 1984; Schaefer *et al.* 1986).

Six nominal species [*D. australis* Ozawa, Oda & Ida 1990, *D. orientalis* Matsubara 1940, *D. pacificus* Günther 1889, *D. proximus* Parr 1931, *D. rebainsi* Krefft & Parin 1972, and *D. taenia* Günther 1873] are currently recognized in *Diplophos* (Fricke *et al.* 2019), although *D. pacificus*, known only from a single poorly preserved specimen, is probably invalid according to Ozawa *et al.* (1990). Ozawa *et al.* (1990) reviewed the systematics of the *Diplophos taenia* species complex, characterized by the last two AC photophores grouped together (all of the above species except for *D. rebainsi*), and described their morphological characters on the basis of the types and many additional specimens collected circumglobally.

During a recent ichthyofaunal survey of the waters off southwestern Taiwan, two specimens of *Diplophos* with the last two AC photophores grouped were obtained at the Dong-gang fish market. Five additional specimens from the same market, and two others from the South China Sea and waters north of Papua New Guinea were found subsequently in museum collections. With meristic characters clearly unique within the genus, the specimens were recognized as a new species, which is formally described below.

Methods and materials

All measurements were made on the left side using digital calipers and rounded to the nearest 0.1 mm. Standard and head lengths are abbreviated as SL and HL, respectively. Rays of vertical fins and vertebrae were counted from

radiographs. Terminology of photophores, and methods for counts and measurements follow Ozawa *et al.* (1990). Photophore descriptions were mostly based on the holotype (due to the poor condition of the skin and photophores in all remaining type specimens; the precise arrangement of accessory photophores was unclear and therefore their counts were deduced from the few remaining traces). Descriptions of fresh coloration were based on color photographs of the holotype and one paratype (NMMB-P27286, 100.5 mm SL). The type series of the new species is deposited in Biodiversity Research Center, Academia Sinica, Taipei (ASIZP) and the fish collection of the National Museum of Marine Biology & Aquarium, (NMMB-P).

Taxonomy

Diplophos vicinia sp. nov.

English name: Neighbor Portholefish

Figures 1–3; Tables 1–2

Holotype. NMMB-P29097, 127.6 mm SL, off Dong-gang, Pingtung, South China Sea, Taiwan, 21 Mar. 2018, obtained at fish-landing ground at Dong-gang; collected by commercial mid-water trawl.

Paratypes. Collection locality and method same as holotype: ASIZP 64190, 2 specimens, 84.4–95.0 mm SL, 24 Mar. 2004; NMMB-P9246, 99.7 mm SL, NMMB-P30714, 101.9 mm SL, 18 Sept. 2008; NMMB-P11930, 129.7 mm SL, 28 Feb. 2011; NMMB-P27286, 100.5 mm SL, 14 Oct. 2017. South China Sea (22°04'N, 120°27'E): ASIZP 64180, 73.9 mm SL, 25 March 2004. Between Papua New Guinea and Micronesia (02°42'N, 150°03'E): ASIZP 73845, 143.5 mm SL, 27 August 2010.

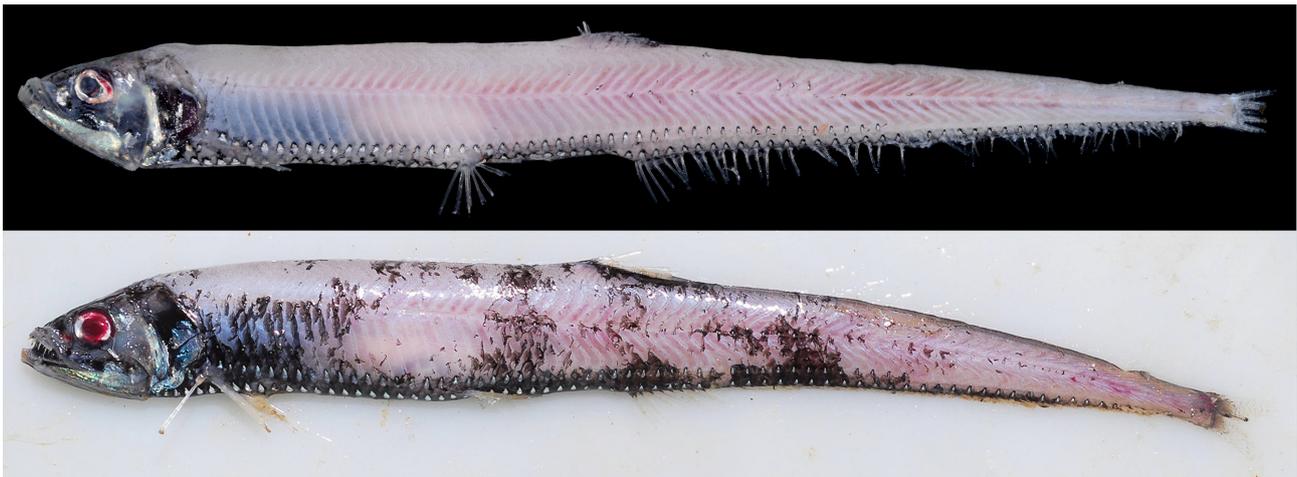


FIGURE 1. Type specimens of *Diplophos vicinia* sp. nov. in fresh condition. Top: NMMB-P29097, 127.6 mm SL, holotype from southwestern Taiwan; bottom: ASIZP 73845, 143.5 mm SL, paratype from between Papua New Guinea and Micronesia (photo taken by M.-Y. Lee).

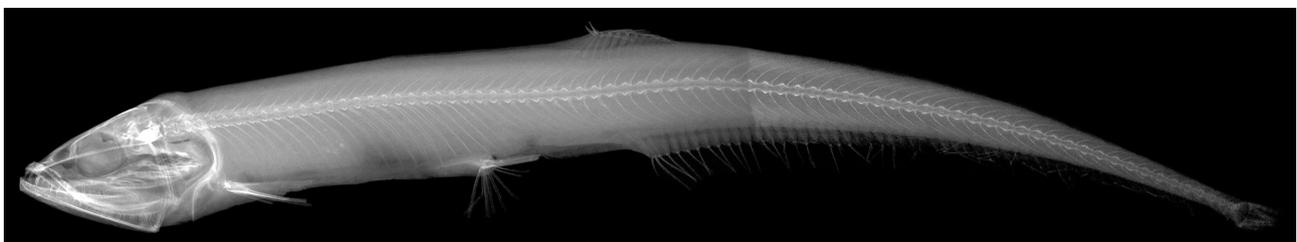


FIGURE 2. Radiograph of holotype of *Diplophos vicinia* sp. nov. (NMMB-P29097, 127.6 mm SL).

Diagnosis. A species of *Diplophos* with the following combination of characters: anal-fin rays 57–59; branchiostegal rays 14; gill rakers 4 + 10–11=14–15; abdominal vertebrae 30–32; caudal vertebrae 44–45; total vertebrae 74–76. Photophores: IP 13–14, PV 18–19, IV 31–32, VAV 12–13, AC 37–39 + 2, IC 83–86; last two AC

photophores grouped, separation less than half that of preceding photophores; dorsal-fin origin closer to snout than caudal-fin base, pre-dorsal-fin length 45.2–47.3% SL.

Description. Counts and measurements are given in Tables 1 and 2. The following data are given for the holotype, with values of paratypes in parentheses, unless otherwise indicated.

Body strongly elongated, its greatest depth (usually at base of pelvic-fin) 10.3 (8.7–13.8) in SL; dorsal and ventral outlines almost straight along abdomen, gradually becoming shallower along tail. Body and head strongly compressed laterally, progressively more so toward the caudal peduncle; snout to anus less than half body length. Scales on body lost in all specimens.

TABLE 1. Meristic data of the type series of *Diplophos vicinia* sp. nov. and *D. taenia*.

	<i>D. vicinia</i>		<i>D. taenia</i>
	Holotype	Paratypes	Non-type
	NMMB-P29097	n=8	ASIZP 75043
Standard length	127.6	73.9–143.5	114.5
Counts			
Dorsal-fin rays	12	11–12	10
Anal-fin rays	57	57–59	damaged
Pectoral-fin rays	10	9–10	9
Pelvic-fin rays	8	8	8
Caudal-fin rays	10 + 9	10 + 9	10 + 9
Branchiostegal rays	14	14	14
Gill rakers	4 + 10=14	4 + 10–11=14–15	3 + 9=12
Abdominal vertebrae	30	30–32	38
Caudal vertebrae	44	44–45	55
Total vertebrae	74	74–76	93
Photophores			
IP	13	13–14	19
PV	18	18–19	22+
IV	31	31–32	41+
VAV	13	12–13	17
AC	37 + 2=39	37–39 + 2=39–41	damaged
IC	83	83–86	N/A
OV	18	18–19	25+
VALA	13	12–13	16
OAA	31	31–32	41+
VALB	17	17–19	28
OAB	48	48–50	69+
BR	11	11–12	12

Head small, 6.6 (6.0–6.8) in SL; snout short, moderately pointed, its length greater than eye diameter. Eye moderately large, circular, its diameter 4.1–5.0 in HL. Olfactory laminae inside nostril 21–23, visible externally.

Mouth large, weakly oblique, ventral margin of maxilla strongly curved, posteriorly nearly reaching the margin of preoperculum. Single row of large caniniform teeth on all jaws, one to three small sharp teeth between each large caniniform tooth; teeth present from near symphysis of premaxilla to posterior end of maxilla, largest on premaxilla, slightly larger than those on maxilla and dentary; single middle-sized tooth row on anterolateral aspect of dentary; two small conical teeth on vomer; single row of three to seven small conical teeth on palatine. Two small teeth on anterior part of basihyal. Four gill arches present, a well-developed slit behind fourth; gill rakers on first to third gill arches comb-like, but on fourth gill arche knob-like; lowermost upper gill raker and uppermost lower gill raker closely attached to each other. Pseudobranch small with 7 (3–10) short filaments.

All fin rays short, transparent and fragile; dorsal-fin base short, originating anterior to origin of anal fin, ending slightly posterior to anal-fin origin; anal-fin base long, its length 7.4 (7.3–10.6) times dorsal-fin base length; pectoral fin small, inserted level with posteroventral portion of gill slit; pelvic fin small, closer to anal-fin origin than closest point of pectoral-fin base; caudal fin small, its maximum length less than caudal-peduncle length.

Head photophores (Fig. 3). Single supraorbital photophore (ORB) at anterodorsal corner of eye between eye and nostril, small, embedded under skin; 12 small photophores in horizontal series along ventral margin of eye; one large photophore below anteroventral portion of eye; 9 small photophores in horizontal linear series below middle of eye; one medium-sized photophore below posteroventral portion of eye; one large photophore (anteriormost one of OP) beneath middle of preopercle, followed by 6 small photophores in horizontal linear series along dorsal margin of premaxilla; one large photophore posterior to and just below dorsal margin of preopercle; 5 small photophores in vertical series beneath border of preopercle and opercle; 5 small photophores in longitudinal series beneath ventral margin of preopercle; 2 large elongated photophores (posterior two of OP) beneath border of subopercle and interopercle; two series of 5 or 6 small photophores on interopercle; single row of ca. 26 small photophores, embedded in black membrane (just below base of teeth) along lateral aspect of dentary, posteriormost curving upward.

Main body photophores. Photophores vertically elongated except two posteriormost AC. Latter smaller than preceding photophores, not attached to each other, separated by less than half and distance between preceding photophores. A single specimen (ASIZP 64190) with nine VALC photophores (others lost; all missing, presumably lost, in other specimens).

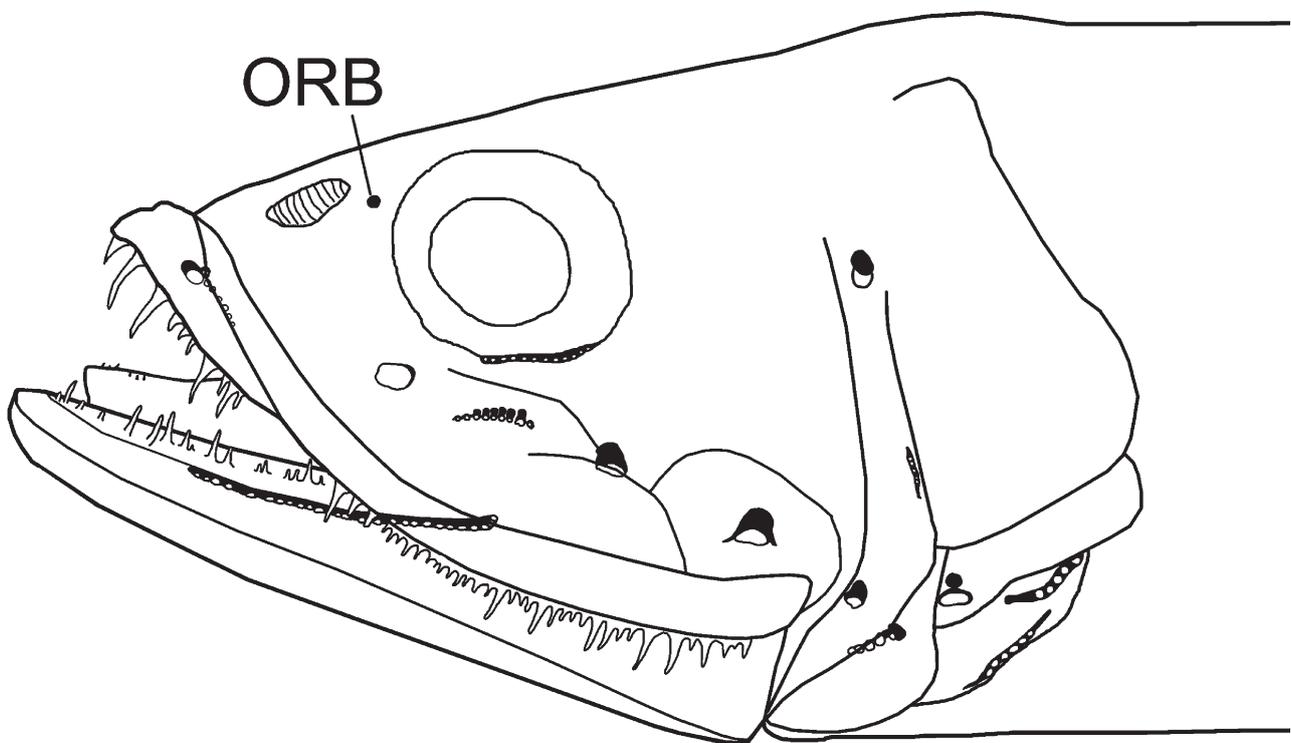


FIGURE 3. Head photophores on the holotype (NMMB-P29097, 127.6 mm SL) of *Diplophos vicinia* sp. nov.

TABLE 2. Morphometric data of type series of *Diplophos vicina* sp. nov. and *D. taenia* (Mean values in parentheses).

	<i>D. vicina</i>		<i>D. taenia</i>
	Holotype	Paratypes	Non-type
	NMMB-P29097	n=8	ASIZP 75043
Standard length (mm)	127.6	73.9–143.5	114.5
%SL			
Body depth	9.7	7.3–11.5 (9.3)	9.1
Body width	3.6	2.6–4.1 (3.2)	2.9
Caudal-peduncle depth	1.9	1.7–2.3 (2.0)	2.0
Caudal-peduncle length	3.5	2.9–3.2 (2.8)	damaged
Head length	15.1	14.8–16.8 (15.8)	16.3
Head depth	10.1	10.0–11.1 (10.5)	10.2
Postorbital head depth	8.4	8.4–9.5 (9.1)	9.5
Snout length	4.0	3.9–4.6 (4.2)	3.8
Eye diameter	3.5	3.0–4.1 (3.6)	3.8
Interorbital width	2.8	2.4–3.1 (2.9)	2.5
Upper jaw length	11.2	10.5–12.0 (11.3)	11.1
Premaxillary length	4.4	3.7–5.3 (4.5)	5.3
Toothed maxillary length	6.6	6.0–7.6 (6.9)	6.2
Lower jaw length	11.5	11.0–12.7 (12.0)	11.9
Dorsal-fin base	6.2	4.9–6.0 (5.4)	4.0
Anal-fin base	45.5	45.4–51.7 (47.3)	damaged
Pre-dorsal-fin length	45.2	45.7–47.3 (46.7)	46.6
Pre-anal-fin length	49.5	49.5–51.2 (50.5)	53.5
Pre-pelvic-fin length	35.4	36.0–37.4 (36.5)	38.5
Pectoral-fin base to pelvic-fin base	20.0	19.8–22.1 (20.7)	23.3
Pelvic-fin base to anal-fin origin	13.4	13.0–14.8 (13.8)	15.3

Accessory body photophores. Most specimens with skin abrasion during capture, making precise photophore counts difficult; 33 and 35 abdominal lateral-line photophores (LLA) apparent in ASIZP 64180 and 61490, respectively. Caudal lateral-line photophores completely missing, presumably lost, in all specimens. Eleven (maximum) principal rows of small photophores on body paralleling IC and OA: five on dorsolateral aspect of trunk, uppermost along mid-dorsal line (except on dorsal-fin base); one of small photophores on lateral line slightly larger than other accessory photophores; four on ventral half of trunk; one between IC and OA, from just posterior to gill opening to below end of VALB (anteriormost two photophores in front of pectoral-fin base as large as main photophores). Single medium-sized photophore on midventral line midway between anus and anal-fin origin.

Fresh coloration (Fig. 1). Body uniformly creamy-white due to almost complete skin and scale abrasion, faintly brownish dorsally. Main photophores silver with black anterior margin; accessory body photophores on lateral line silver with black margin. Head black with silver reflection on skin remaining on cheek and opercular; buccal cavity and inner surface of opercle black; iris silver; fins semi-translucent.

Preserved coloration. Head and body uniformly light brown, faintly dusky dorsally. Main photophores silver with black anterior margin; accessory body photophores on lateral line silver with black margin; other accessory body photophores black. Head blackish, opercular and isthmus solid black. Buccal cavity, inner surface of opercle, gill rakers dusky. Iris brown with silver reflection. Peritoneum black.



FIGURE 4. Specimen of *Diplophos taenia* Günther 1873, South China Sea, fresh condition. ASIZP 75043, 114.5 mm SL.

Etymology. The specific name, *vicinia* (meaning “neighbor” in Latin), is given in reference to the grouping of the last two AC photophores.

Distribution. *Diplophos vicinia* sp. nov. has been collected mainly off southwestern Taiwan, although the single specimens collected in the northern South China Sea and from north of Papua New Guinea.

Remarks. Of the six nominal species recognized in the genus *Diplophos*, the new species described herein is distinct in having greater numbers of total gill rakers (14–15 vs. 12–13, usually 12, in congeners), and VAV photophores (12 vs. 11 in *D. pacificus*, 14–17 in other species). Ozawa *et al.* (1990) divided the genus into two groups, based on grouping or separation of the last two AC photophores, with only *D. rebaini* and *Manducus greyae* (Johnson 1970) (previously included in the genus *Diplophos* by Smith *et al.* 1991) included in the latter group. *Diplophos vicinia* is distinguished from the other five species that also have the last two AC photophores grouped as follows: abdominal vertebrae 30–32 in *D. vicinia* (vs. 33–41); caudal vertebrae 44–45 (vs. 48–60); total vertebrae 74–76 (vs. 83–100); IP 13–14 (vs. 15–19); PV 18–20 (vs. 23–29); IV 31–34 (vs. 38–48); AC 38–40 (vs. 43–53); IC 85 (92–115) (comparative data adopted from Ozawa *et al.* 1990). Compared with *D. rebaini* (last two AC photophores well separated), *D. vicinia* has anal-fin rays 57–58 (vs. 47–53); branchiostegal rays 14 (vs. 10–11); VAV 12 (vs. 15–17); AC 38–40 (vs. 32–34); BR 11 (vs. 7–8); dorsal-fin origin closer to snout than caudal-fin base, pre-dorsal-fin length 45.2–47.3% SL (vs. closer to caudal-fin base than snout, and pre-dorsal-fin length 61.2–64.4% SL) (data adopted from Schaefer *et al.* 1986; Harold 1999; Kenaley & Stewart 2015).

Most of the *Diplophos* specimens examined here had been previously identified as *D. taenia* or *D. orientalis*. Except for a single specimen (ASIZP 75043; Fig. 4) of *D. taenia* collected from open waters of the South China Sea, all of the *Diplophos* specimens collected in Taiwanese waters reported on herein are identified as *D. vicinia*.

Comparative material. *Diplophos taenia*: ASIZP 75043, 114.5 mm SL, South China Sea (22°03'N, 118°54'E).

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